

IN THE CLAIMS

The following listing of the claims is provided in accordance with 37 C.F.R. §1.121:

1. (currently amended) A phosphor comprising a material having a formula of $\text{AMgD}_{10}\text{O}_{17}:\text{Eu}^{2+},\text{Mn}^{2+}$, wherein A is at least an alkaline-earth metal selected from the group consisting of Ba, Sr, Ca, and combinations thereof; and D is at least a metal selected from the group consisting of [[Al],] Ga, In, and combinations thereof; wherein Eu^{2+} ions are present in an amount from about 10 to about 50 atom percent of a combined quantity of A ions and europium ions, and Mn^{2+} ions are present in an amount from about 5 to about 30 atom percent of a combined quantity of magnesium ions and manganese ions.

2. (currently amended) A phosphor comprising a material having a formula of $\text{AMgD}_{10}\text{O}_{17}:\text{Eu}^{2+},\text{Mn}^{2+}$, wherein A is at least an alkaline-earth metal selected from the group consisting of Sr, Ca, and combinations thereof; and D is at least a metal selected from the group consisting of [[Al],] Ga, In, and combinations thereof; wherein Eu^{2+} ions are present in an amount from about 10 to about [[40]] 50 atom percent of a combined quantity of A ions and europium ions, and Mn^{2+} ions are present in an amount from about 5 to about [[20]] 30 atom percent of a combined quantity of magnesium ions and manganese ions.

3. (original) The phosphor according to claim 1, wherein Eu^{2+} ions are present in an amount from about 20 to about 40 atom percent of a combined quantity of A ions and europium ions, and Mn^{2+} ions are present in an amount from about 10 to about 20 atom percent of a combined quantity of magnesium ions and manganese ions.

4. (cancelled).

5. (original) The phosphor according to claim 1, wherein a portion of magnesium ions is substituted with Zn in an amount from about 0.01 to about 99.99 atom percent of a combined quantity of Mg, Mn, and Zn ions.

6. (currently amended) A method for producing a phosphor, the method comprising:

providing amounts of oxygen-containing compounds of magnesium; europium; manganese; at least another alkaline-earth metal, which is selected from the group consisting of barium, strontium, calcium, and combinations thereof; and at least a metal of Group III-B of the Periodic Table of the Elements, the metal of Group-IIIB being selected from the group consisting of [[Al,]] Ga, In, and combinations thereof;

mixing together the oxygen-containing compounds to form a mixture; and

firing the mixture at a temperature between about 1000 $^{\circ}\text{C}$ and about 1600 $^{\circ}\text{C}$ under a reducing atmosphere for a sufficient period of time to convert the mixture to said phosphor having a formula of $(\text{A}_{1-a}\text{Eu}_a)(\text{Mg}_{1-b}\text{Mn}_b)\text{D}_{10}\text{O}_{17}$; wherein A is said at least another alkaline-earth metal, D is said at least a metal of Group-IIIB, $0.001 < a = 0.5$, and $0.001 < b = 0.3$.

7. (original) The method according to claim 6, wherein the reducing atmosphere is selected from the group consisting of hydrogen, carbon monoxide, ammonia, and mixtures thereof with an inert gas selected from the group consisting of nitrogen, helium, neon, argon, krypton, and xenon.

8. (original) The method according to claim 6, wherein the reducing atmosphere is selected from the group consisting of a product of a incomplete combustion carbon in air, and decomposition products of compounds that give at least one gas selected from the group consisting of hydrogen and carbon monoxide.

9. (original) The method according to claim 6, wherein the reducing atmosphere is selected from the group consisting of decomposition products of ammonia and hydrazine.

10. (currently amended) The method according to claim 6, wherein the firing temperature is in a range from about 1400 [[C]] °C to about 1600 [[C]] °C.

11. (original) The method according to claim 6, wherein the firing time is in a range from about 1 minute to 10 hours.

12. (original) The method according to claim 6, wherein the oxygen-containing compounds are selected from the group consisting of oxides, carbonates, nitrates, sulfates, phosphates, citrates, carboxylates, and combinations thereof.

13. (original) The method according to claim 6, further comprising adding a flux to the oxygen-containing compounds before the step of mixing, wherein the flux comprises a fluoride of at least an element selected from the group consisting of Mg, Eu, Mn, said at least an alkaline-earth metal, and said at least a Group-IIIB metal.

14. (currently amended) A method for producing a phosphor, the method comprising:

providing a first solution that comprises compounds of magnesium; europium; manganese; at least another alkaline-earth metal, which is selected from the group consisting of barium, strontium, and calcium; and at least a Group-IIIB metal selected from the group consisting of [[Al]], Ga, In, and combinations thereof;

providing a second solution, which comprises at least a compound that is capable of producing a precipitate when the first and second solutions are mixed together;

mixing the first and second solutions to produce a precipitate containing magnesium, europium, manganese, said at least another alkaline-earth metal, and said at least a Group-IIIB metal; and

firing the mixture under a reducing atmosphere at a temperature and for a sufficient period of time to convert the mixture to a phosphor having a formula of $(A_{1-a}Eu_a)(Mg_{1-b}Mn_b)D_{10}O_{17}$; wherein A is said at least another alkaline-earth metal; D is said at least a Group-IIIB metal; $0.001 < a = 0.5$; and $0.001 < b = 0.3$.

15. (original) The method according to claim 14, wherein the second solution comprises a compound selected from the group consisting of ammonium hydroxide; and hydroxides of at least one element selected from the group consisting of magnesium, europium, manganese, said at least another alkaline-earth metal, and said at least a Group-IIIB metal.

16. (original) The method according to claim 14, wherein the second solution comprises a compound selected from the group consisting of organic esters of carboxylic acids, organic amines, and combinations thereof.

17. (original) The method according to claim 14, wherein the reducing atmosphere is selected from the group consisting of hydrogen, carbon monoxide, ammonia, and mixtures thereof with an inert gas selected from the group consisting of nitrogen, helium, neon, argon, krypton, and xenon.

18. (original) The method according to claim 14, wherein the reducing atmosphere is selected from the group consisting of a product of an incomplete combustion of carbon in air, and decomposition products of compounds that give at least one gas selected from the group consisting of hydrogen and carbon monoxide.

19. (original) The method according to claim 14, wherein the reducing atmosphere is selected from the group consisting of decomposition products of ammonia and hydrazine.

20. (currently amended) The method according to claim 14, wherein the firing temperature is in a range from about 1400 $^{\circ}\text{C}$ to about 1600 $^{\circ}\text{C}$.

21. (original) The method according to claim 14, wherein the firing time is in a range from about 1 minute to 10 hours.

22. (currently amended) A phosphor blend comprising:

a phosphor comprising a material having a formula of $\text{AMgD}_{10}\text{O}_{17}:\text{Eu}^{2+}, \text{Mn}^{2+}$, wherein A is at least an alkaline-earth metal selected from the group consisting of Ba, Sr, Ca, and combinations thereof; and D is at least a metal selected from the group consisting of $[\text{Al}]$, Ga, In, and combinations thereof; wherein Eu^{2+} ions are present in an amount from about 10 to about 50 atom percent of a combined quantity of A ions and europium ions, and Mn^{2+} ions are present in an amount from about 5 to about 30 atom percent of a combined quantity of magnesium ions and manganese ions; and

at least another phosphor emitting a light color selected from the group consisting of blue, blue-green, green, yellow, yellow-orange, orange-red, and red.

23. (original) The phosphor blend according to claim 22, wherein said at least another phosphor is selected from the group consisting of

$(\text{Ba}, \text{Sr}, \text{Ca})_5(\text{PO}_4)_3(\text{Cl}, \text{F}, \text{OH}):\text{Eu}^{2+}$; $(\text{Ba}, \text{Sr}, \text{Ca})\text{MgAl}_{10}\text{O}_{17}:\text{Eu}^{2+}$; $(\text{Ba}, \text{Sr}, \text{Ca})\text{BPO}_5:\text{Eu}^{2+}$; $\text{Sr}_4\text{Al}_{14}\text{O}_{25}:\text{Eu}^{2+}$; $\text{BaAl}_8\text{O}_{13}:\text{Eu}^{2+}$; $2\text{SrO} \cdot 0.84\text{P}_2\text{O}_5 \cdot 0.16\text{B}_2\text{O}_3:\text{Eu}^{2+}$; MgWO_4 ; BaTiP_2O_8 ; $(\text{Ba}, \text{Sr}, \text{Ca})\text{MgAl}_{10}\text{O}_{17}:\text{Eu}^{2+}, \text{Mn}^{2+}$; $(\text{Ba}, \text{Sr}, \text{Ca})_5(\text{PO}_4)_3(\text{Cl}, \text{F}, \text{OH}):\text{Sb}^{3+}$; $\text{LaPO}_4:\text{Ce}^{3+}, \text{Tb}^{3+}$; $\text{CeMgAl}_{11}\text{O}_{19}:\text{Tb}^{3+}$; $\text{GdMgB}_5\text{O}_{10}:\text{Ce}^{3+}, \text{Tb}^{3+}, \text{Mn}^{2+}$; $\text{GdMgB}_5\text{O}_{10}:\text{Ce}^{3+}, \text{Tb}^{3+}$; $(\text{Tb}, \text{Y}, \text{Lu}, \text{La}, \text{Gd})_3(\text{Al}, \text{Ga})_5\text{O}_{12}:\text{Ce}^{3+}$; $(\text{Ba}, \text{Sr}, \text{Ca})_5(\text{PO}_4)_3(\text{Cl}, \text{F}, \text{OH}):\text{Eu}^{2+}, \text{Mn}^{2+}, \text{Sb}^{3+}$; $(\text{Y}, \text{Gd}, \text{La}, \text{Lu}, \text{Sc})_2\text{O}_3:\text{Eu}^{3+}$; $(\text{Y}, \text{Gd}, \text{La}, \text{In}, \text{Lu}, \text{Sc})\text{BO}_3:\text{Eu}^{3+}$; $(\text{Y}, \text{Gd}, \text{La})(\text{Al}, \text{Ga})\text{O}_3:\text{Eu}^{3+}$;

(Ba,Sr,Ca)(Y,Gd,La,Lu)₂O₄:Eu³⁺; (Y,Gd)Al₃B₄O₁₂:Eu³⁺; monoclinic Gd₂O₃:Eu³⁺;
(Gd,Y)₄(Al,Ga)₂O₉:Eu³⁺; (Ca,Sr)(Gd,Y)₃(Ge,Si)Al₃O₉:Eu³⁺; (Sr,Mg)₃(PO₄)₂:Sn²⁺;
GdMgB₃O₁₀:Ce³⁺,Mn²⁺; 3.5MgO-0.5MgF₂-GeO₂:Mn⁴⁺.

24. (original) The phosphor blend according to claim 22, wherein said at least another phosphor is selected from the group consisting of
(Sr,Ca,Mg,Zn)₂P₂O₇:Eu²⁺,Mn²⁺; (Sr,Ba,Ca)₃(PO₄)₃(Cl,F,OH):Eu²⁺; and Sr₄Al₁₄O₂₅:Eu²⁺.

25. (currently amended) A light source emitting visible light, the light source comprising:

a radiation source that emits in a wavelength range from about 250 nm to about 480 nm; and

a phosphor having a formula of (A_{1-a}Eu_a)(Mg_{1-b}Mn_b)D₁₀O₁₇; wherein A is at least an alkaline-earth metal other than Mg, D is at least a Group-IIIB metal comprising Ga, In, and combinations thereof; 0.001 < a = 0.5, and 0.001 < b = 0.3, which phosphor is disposed adjacent to the radiation source to receive the radiation and emit the visible light.

26. (currently amended) The light source according to claim [[24]] 25, wherein the radiation source comprises a UV/blue light emitting diode ("LED").

[[25]] 27. (currently amended) The light source according to claim 25, wherein the phosphor is dispersed in a transparent casting, which is disposed adjacent to the radiation source.

[[26]] 28. (original) The light source according to claim 25, wherein the radiation source emits radiation having wavelengths in a range from about 250 nm to about 420 nm.

[[27]] 29. (original) The light source according to claim 25, wherein the phosphor is a component of a phosphor blend that comprises at least one other phosphor emitting light selected from the group consisting of blue, blue-green, green, yellow, yellow-orange, orange-red, and red light.

[[28]] 30 (currently amended) The light source according to claim [[26]] 27, further comprising particles of a scattering material dispersed in the transparent casting.

[[29]] 31. (currently amended) The light source according to claim [[24]] 25, wherein the radiation source is a gas discharge device.

[[30]] 32. (currently amended) The light source according to claim [[24]] 31, wherein the gas discharge device is selected from the group consisting of low-, medium-, and high-pressure mercury gas discharge lamps.

[[31]] 33. (currently amended) The light source according to claim [[31]] 25, wherein the phosphor is a component of a phosphor blend that comprises at least one other phosphor emitting light selected from the group consisting of blue, blue-green, green, yellow, yellow-orange, orange-red, and red light.

[[32]] 34. (currently amended) The light source according to claim [[24]] 25, wherein the radiation source is a cathode-ray tube.